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## ARTIFICIAL GRASS SYSTEM

The invention relates to an artificial grass system for forming a field of grass comprising artificial blades of grass distributed at a main surface and provided with liquid supply means for supplying a liquid to said main surface. The invention moreover relates to a 5 artificial grass mat, an artificial field of grass and a method of improving a field of grass.

Artificial grass mats known up to now consist of artificial blades of grass, made of plastics like for instance polypropylene, polyethylene and teflon, which are provided on a support layer. Said fields are widely used to play ball sports like soccer and hockey but 10 have a well-known disadvantage. When someone falls down on the artificial grass and especially upon making a sliding-tackle on it high temperatures are locally developed which may cause nasty wounds. Generally, one tries to prevent such hurting by keeping the main surface artificial grass field wet by means of liquid supply means. This is especially done with so called water fields used for field hockey. However it is difficult 15 to adjust the amount of water required and it generally requires a lot of water to keep the artificial field of grass sufficient wet to avoid severe injuries upon sliding on the field. Moreover, during spraying water over said main surface the field is out of order for playing the game.

European patent nr. 1080274 describes an artificial lawn of grass consisting of hollow 20 artificial blades of grass having a U-form. These artificial blades of grass are supposed to receive liquid from natural rain or sprinkled water and humidity in the air. To facilitate the entrance of liquid within the hollow core, small pores are provided in the tuft walls of said blades to allow air within said core to escape. Water can enter the hollow cores through the same openings. A disadvantage of this known artificial grass 25 system is the limited amount of water which may be absorbed and stored in the grass blades and accordingly may subsequently be released upon playing on the field. As a consequence the system will soon be depleted and no longer fit for further use as long as the blades are filled again. It is moreover not easy to regulate the quantity of liquid that will be kept by those blades of grass and filling the blades by for instance sprinkling the 30 main surfaces may turn out water and time-consuming.

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The object of the present invention is inter alia to provide an artificial grass system which may be applied to avoid these and other disadvantages.

To this end an artificial grass system of the type described in the opening paragraph according to the invention is characterized in that said liquid supply means comprises a  
5 liquid release layer underneath said artificial blades of grass and in that said artificial blades of grass comprise at least one capillary channel extending from within said liquid release layer to said main surface. Said artificial blades generally will have a substantial straight thread-like form with their channels opening at opposite ends. The blades may be slightly bend, particularly at their ends. Liquid, particularly water is supplied by the  
10 liquid release layer and fed to the main surface by the capillary channels within said artificial grass blades. This is a self controlled and adjusting process governed by the capillary action of these channels. By the capillary effect, the capillary channels, upon losing liquid, will fill themselves again with liquid from the release layer and carry this to the main surface. As the main surface becomes depleted more liquid will thus be  
15 supplied by the channels to counteract a dry main surface. Because liquid is continuously fed from underneath the main surface, the field may be continuously be played on and requires no further maintenance. These capillary blades of grass may be provided al over the field of grass or inserted in between conventional artificial blades or natural blades of grass.  
20 In a preferred embodiment the artificial grass system according to the invention is characterized in that said liquid release layer comprises a liquid absorbing and releasing layer, particularly one comprising at least one material taken from a group of felt, cotton and soil. Especially felt and cotton have a large capability both to absorb and release liquid. and hence turn out to be capable of easily and quickly releasing sufficient  
25 amounts of water to keep the main surface sufficient wet under varying conditions.

In a special embodiment the artificial grass system according to the invention is characterized in that said artificial grass blades comprise the at least one capillary channel as at least one artificial nerve within an artificial leave. The blades may thus

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each comprise one or more capillary channels to carry liquid from the release layer to the main surface. By providing the channels as artificial nerves the appearance remains quite natural.

A further embodiment of the artificial grass system according to the invention is  
5 characterized in that said artificial grass blades extend along a tubular core which comprises the at least one capillary channel. The core may look like an artificial backbone of the grass blade to give it a natural appearance and may be scaled to comprise a number of capillary channels to enhance the liquid feeding power. To this end, a further special embodiment of the artificial grass system according to the invention is  
10 characterized in that said tubular core is filled at least in part with a liquid conductor, more particularly one with said liquid conductor comprising a hydrophilic material, preferably taken from a group of cotton and sponge. Preferably at least some of the liquid conductors may entirely fill the tubular core for instance in the form of a nucleus of sponge or a thick wire of cotton, to enlarge the capillary effect.  
15 In a further special embodiment said artificial grass system according to the invention is characterized in that said tubular core comprises a tube wall of a material taken from a group of silicon, polypropylene, polyethylene and teflon.  
In a preferred embodiment of the invention the artificial grass system according to the invention is characterized in that said liquid release layer is provided on a buffer layer capable of at least temporarily storing said liquid. Preferably this buffer layer comprises rubber, more particularly sintered rubber, capable of storing a lot of liquid for instance by irrigation, and releasing the liquid again as soon as the liquid release layer needs it. The rubber layer moreover provides for a shock damping action which renders the field more comfortable to play on and less prone to bone injuries among the players.  
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25 In a still a further preferred embodiment the artificial grass system according to the invention is characterized in that said artificial grass blades are incorporated in a support layer with one end projecting from said support layer to penetrate the liquid release layer

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and an opposite end projecting from said support layer at said main surface. More particularly, a further preferred embodiment of the artificial grass system according to the invention is characterized in that said artificial grass blades are interwoven in said support layer. The support layer is for instance made of latex or a suitable, durable  
5 fabric. By processing the artificial blades of grass in a support layer an interlinked, coherent grass system is obtained which may be rolled out or otherwise laid on a field once the liquid release layer is in place. This not only saves time but moreover enables the precise provision of the artificial blades beforehand in a controlled environment.

According to the present invention a field of grass and a grass mat are characterized in  
10 that they comprises at least in part the artificial grass system according to the invention. A method of improving a field of grass, according to the invention, is characterized by by inserting artificial grass blades of the artificial grass system according to invention within said field of grass. In this way the present invention provides processes to prepare and improve several types of artificial grass field. The artificial field of grass may be  
15 provided with capillary blades according to the present invention all over the surface. Alternatively the capillary blades may be provided and inserted in an existing field of grass in between existing natural or artificial grass blades, the latter being solid.

According to yet another aspect of the invention a process to improve the quality of a natural field of grass is provided by the application of capillary blades between natural  
20 blades of grass in which case generally the liquid will be adsorbed up from the groundwater form the underlying liquid release layer of soil. In this way the capillary tubes or capillary nerves are for instance applied to repair the bad parts of an artificial or natural grass field. Generally the capillary blades which are to be applied in this way have to have a length of about 10 - 25 cm, preferably between about 15 - 20 cm, to be  
25 able to reach the ground water.

The known problems of hurting or burning the skin when someone slides over an artificial grass associated with known artificial fields of grass are solved by the grass system of the invention in which system the supply of liquid is provided by irrigation in

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stead of by the rain or sprinkling, which means that the quantity of liquid supplied may be regulated. The field will be irrigated either by supplying water to the liquid release layer, or more preferred, by supplying water to a water buffer layer from which layer water will be transferred to the liquid release layer. Besides by sprinkling or direct 5 irrigation the amount of liquid stored in any of the layers is also replenished during natural rain.

To provide a maximum capillary effect, the openings at both ends of the capillary channels are about the same. When the liquid release layer, such as a felt layer, is wet the capillary channels will absorb an amount of liquid, generally water, what is as large 10 as possible and will release this when there is a pressure on the artificial grass surface, especially when a sliding-tackle is made on the grass field. In that case liquid from the capillary channels, absorbed from the felt layer, will be fed to the surface upon contact of someone's body with the artificial blades of grass. This liquid has a sort of lubricant or quenching function especially when someone's skin is hurt like burned by the 15 artificial grass field. After the sliding-tackle has been made the emptied capillary channels will fill themselves again with liquid. Moreover, the constant process of evaporation will bring on the player a feeling of cool grass which causes generally a large advantageous psychological effect.

The new capillary artificial grass field is formed when the new capillary grass mat comprising blades of grass, capillaries between or inside the artificial blades of grass 20 and a support layer is applied on a second layer made of material which is able to adsorb liquid and to release it easily, for instance made of felt. Preferably, this new capillary grass mat is glued with said layer. In a preferred embodiment the liquid release layer is applied on a third layer with liquid buffering properties being a fine, porous mat as for 25 instance a rubber mat lying on a flatted bottom of for instance sand. Said porous mat serves a number of purposes:: first of all to store excess liquid, secondly as shock absorbing device and thirdly for a good bond of the liquid release layer which forms part of an optimal playing field.

The present invention will be further elucidated with reference to preferred embodiments and the accompanying drawings. In the drawings:

5 figure 1: shows a slightly bended capillary tube (1) comprising a liquid conductor (2) which tube ends in the felt liquid adsorbing and releasing layer (3);

10 figure 2: shows a slightly bended capillary nerve (4) in a green blade (5) filled with a liquid conductor (2) which nerve ends in the felt liquid adsorbing and releasing layer (3);

15 figure 3: shows a substantially straight capillary nerve (5) inside artificial blades of grass (6) comprising a liquid conductor (2) which nerve ends in the underground of sand (7); and

20 figure 4: shows an artificial grass field has been depicted in normal position (A) and after a sliding-tackle (B), with slightly bended capillary tube (1) some of which filled with a liquid conductor (2), which tubes end in felt, the liquid adsorbing and releasing layer (3), artificial grass blades (8) in the latex support layer (9); the liquid storing layer (10) of rubber, particularly hydro rubber is located under the liquid adsorbing and releasing layer (3) and above the underground of sand (7).

The figures are schematic and not drawn to scale. Some dimensions are highly exaggerated for the sake of clarity. In the figures preferred embodiments of the invention have been presented.

Figure 1 depicts a artificial blade according to an embodiments of the invention comprising a tubular core comprising a slightly bended thread fully filled with a water conductor (2), extending from the thread to enlarge the capillary effect. Figure 2 depicts a capillary nerve (4) inside an artificial blade of grass (5), also fully filled with a water conductor (2). Upon the application of the capillary tube and/or the capillary nerve the liquid is taken up from the liquid adsorbing and releasing layer 3, as for instance a felt layer.

Figure 2 depicts the artificial grass blade of figure 1 provided with artificial leaves 5 along the tubular core.

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Figure 3 represents a substantially straight tubular core (6) inside artificial blades of grass (5) comprising a liquid conductor (2) with capillary channels which end in the underground of sand or soil (7). The blade of this embodiment may advantageously be applied to repair an existing damaged natural or artificial field of grass. Applying this embodiment the ground water will be absorbed by the capillary core.

In figure 4 the same type of capillary tubes (1) comprising a water conductor has been depicted as in figure 1 together with capillary tubes (1) without water conductor between artificial blades of grass. The artificial blades of grass are attached to a support layer or mat (9), while the capillary tubes are attached on the liquid adsorbing and releasing layer (3). Under this layer the water buffer layer (10) is applied from which layer the water is supplied to the liquid adsorbing and releasing layer (3). Finally, the water buffer layer covers the underground, usually sand (7). In the left side of this figure under A, the artificial grass blades with tubes are present before someone has touched it. Under B the situation of the artificial grass has been depicted after a sliding-tackle where water is released from the capillary tubes which water prevents wounds caused by the local development of high temperatures.

It will be appreciated that the invention is in no way restricted to the embodiments given in this description. For instance, due to the system of three layers ( support layer, liquid adsorbing and releasing layer and water storing layer) as disclosed and the possibility of independent variation thereof the field of artificial grass may be adapted to various ball sports like tennis, soccer, korfball, rugby, baseball, and the like.

Also for indoor sports and sport activities on covered locations the artificial field of grass according to the invention may be applied. Particularly, also the air humidity in the indoor space may be improved in this way. Moreover additives (colour and odour, particularly grass odour) and heating may be applied to the water release layer to improve the quality and appearance of the field.